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Cell Biology (including questions)

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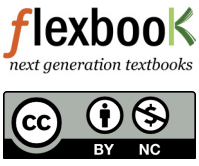
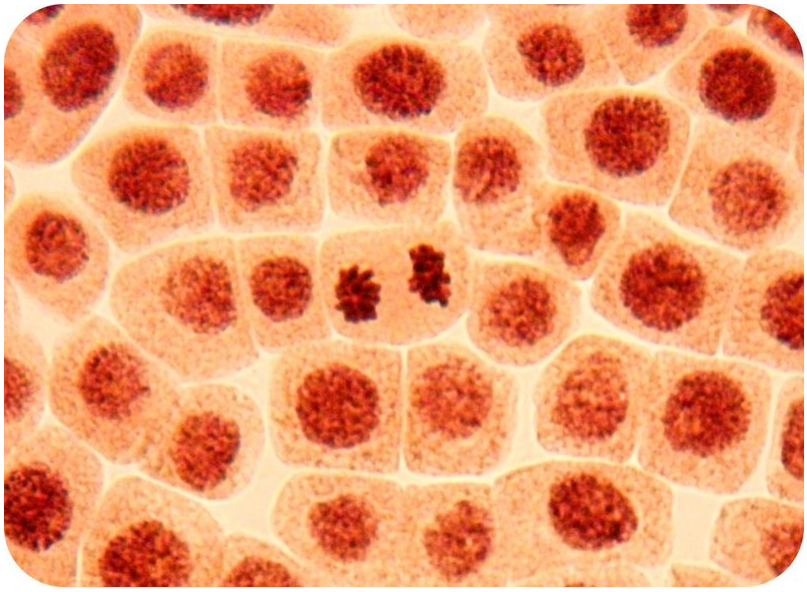


Contents

CHAPTER 1 Cell Biology

- Explain how cells are observed.
- Define the three main parts of the cell theory.
- Explain the levels of organization in an organism.



What are you made of?

Cells make up all living things, including your own body. This picture shows a typical group of cells. But not all cells look alike. Cells can differ in shape and sizes. And the different shapes usually means different functions.

Introduction to Cells

A **cell** is the smallest structural and functional unit of an organism. Some organisms, like bacteria, consist of only one cell. Big organisms, like humans, consist of trillions of cells. Compare a human to a banana. On the outside, they look very different, but if you look close enough you'll see that their cells are actually very similar.

Answer:

- What does "structural unit" mean or seem like to you? If you're stuck, try making a comparison to something similar.
- What is a simple definition for the word "Organism"?

Observing Cells

Most cells are so small that you cannot see them without the help of a **microscope**. It was not until 1665 that English scientist Robert Hooke invented a basic light microscope and observed cells for the first time. You may use light microscopes in the classroom. You can use a light microscope to see cells (**Figure** 1.1). But many structures in the cell are too small to see with a light microscope. So, what do you do if you want to see the tiny structures inside of cells?

Before you read on, stop, think, write:

- Imagine a solution to problem of not being about to see the inside of cells with a light microscope.

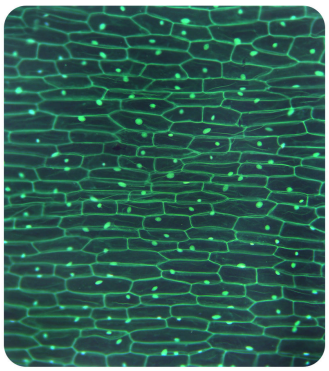


FIGURE 1.1

The outline of onion cells are visible under a light microscope.

In the 1950s, scientists developed more powerful microscopes. A light microscope sends a beam of light through a specimen, or the object you are studying. A more powerful microscope, called an **electron microscope**, passes a beam of electrons through the specimen. Sending electrons through a cell allows us to see its smallest parts, even the parts inside the cell (**Figure** 1.2). Without electron microscopes, we would not know what the inside of a cell looked like.

Electron microscopes are also useful for looking at bacteria, which generally cannot be seen with a light microscope.

Cell Theory

In 1858, after using microscopes much better than Hooke's first microscope, Rudolf Virchow developed the hypothesis that cells only come from other cells. For example, bacteria, which are single-celled organisms, divide in half (after they grow some) to make new bacteria. In the same way, your body makes new cells by dividing the cells you already have. In all cases, cells only come from cells that have existed before. This idea led to the development of one of the most important theories in biology, the **cell theory**.

Cell theory states that:

1. All organisms are composed of cells.
2. Cells are alive and the basic living units of organization in all organisms.

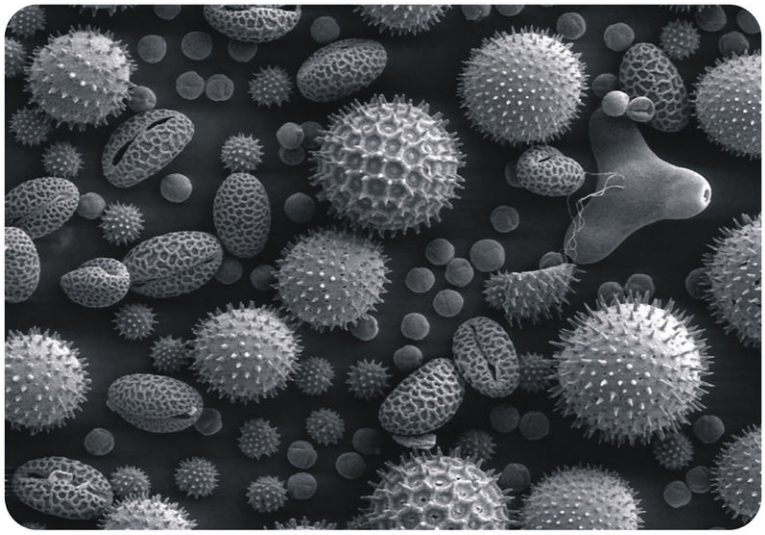


FIGURE 1.2

An electron microscope allows scientists to see much more detail than a light microscope, as with this sample of pollen.

3. All cells come from other cells.

As with other scientific theories, many hundreds, if not thousands, of experiments support the cell theory. Since Virchow created the theory, no evidence has ever been identified to contradict it.

Answer:

- How is Virchow's idea like a tentative explanation?

- In the paragraph, above, theories are described. Recap what is true of theories, below.

Specialized Cells

Although cells share many of the same features and structures, they also can be very different (**Figure** below). Each cell in your body is designed for a specific task. In other words, the cell's function is partly based on the cell's structure . For example:

- Red blood cells are shaped with a pocket that traps oxygen and brings it to other body cells.
- Nerve cells are long and stringy in order to form a line of communication with other nerve cells, like a wire. Because of this shape, they can quickly send signals, such as the feeling of touching a hot stove, to your brain.
- Skin cells are flat and fit tightly together to protect your body.

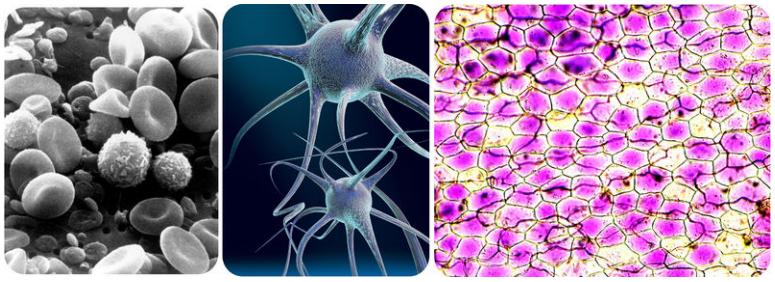


FIGURE 1.3

Connect to your life (this may take a minute or two):

- What is another example (does not have to be science related) when the way something looks and its purpose are linked?

As you can see, cells are shaped in ways that help them do their jobs. Multicellular (many-celled) organisms have many types of specialized cells in their bodies.

Levels of Organization

While cells are the basic units of an organism, groups of cells can perform a job together. These cells are called specialized because they have a special job. Specialized cells can be organized into **tissues**. For example, your liver cells are organized into liver tissue. Your liver tissue is further organized into an organ, your liver. **Organs** are formed from two or more specialized tissues working together to perform a job. All organs, from your heart to your liver, are made up of an organized group of tissues.

These organs are part of a larger system, the **organ systems**. For example, your brain works together with your spinal cord and other nerves to form the nervous system. This organ system must be organized with other organ systems, such as the circulatory system and the digestive system, for your body to work. Organ systems work together to form the entire organism. There are many levels of organization in living things (**Figure** 1.4).

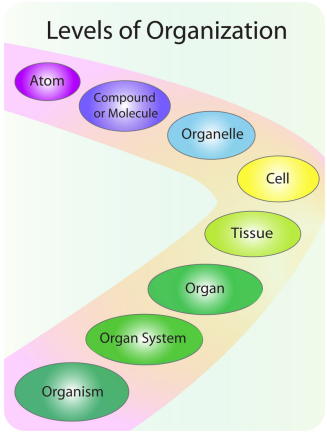


FIGURE 1.4

Levels of organization, from the atom to the organism.

Create/Reimagine

- Design a new way to represent the levels of organization, from Organelle to Organism, using the space below. Your reimagined visual aide should reflect thoughtfulness and attention to detail.

Homework on 23 Sept:

1. Copy the vocab words into your science notebook
2. Answer the review questions in complete sentences

Vocabulary

- **cell**: Basic unit of structure and function of a living organism; the basic unit of life.
- **cell theory**: Scientific theory that all living things are made up of cells, all life functions occur within cells, and all cells come from already existing cells.
- **electron microscope**: Microscope that uses a beam of electrons to magnify an object.
- **microscope**: An instrument that uses lenses to produce magnified images of small objects.
- **organ**: Tissues that work together to perform a specialized function.
- **organ system**: Organs that work together to perform a certain function.
- **tissue**: Groups of cells that work together to perform a specific function.

Summary

- Cells were first observed under a light microscope, but today's electron microscopes allow scientists to take a closer look at the inside of cells.
- Cell theory says that:
  - All organisms are composed of cells.

  - Cells are alive and the basic living units of organization in all organisms.
  - All cells come from other cells.
- Cells are organized into tissues, which are organized into organs, which are organized into organ systems, which are organized to create the whole organism.

Extra Practice

Use the sliding bar to zoom in on this animation to get an idea of the relative sizes of your cells.

- **Cell Size and Scale - The University of Utah** at http://learn.genetics.utah.edu/content/begin/cells/scale/

1. What is the average size of a grain of salt?
2. How big is an amoeba proteus? How big is a paramecium? Remember this relationship for when you study amoeba.
3. How big is a skin cell? How big is a red blood cell? Can you think of any problems that might exist if this relationship was reversed? Explain your thinking fully.
4. How big is an *E. coli* bacterium? How big is a mitochondrion? Remember this relationship for when you study endosymbiosis.
5. Are all cells the same size?

Review

1. What type of microscope would be best for studying the structures found inside of cells?
2. What are the three basic parts of the cell theory?
3. According to Cell Theory, can you create a cell by combining molecules in a laboratory? Why or why not?

Guest Editors:

Ankit, Jamal, Mondo, Chloe, Steven, Khalil,

References

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